



2234 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
NIRCAM				
	1		NIRCam Imaging	(1) NIRCAM-1
	2		NIRCam Imaging	(2) NIRCAM-2
	3		NIRCam Imaging	(3) NIRCAM-3

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
4			NIRCam Imaging	(4) NIRCAM-4
5			NIRCam Imaging	(5) NIRCAM-5
6			NIRCam Imaging	(6) NIRCAM-6
7			NIRCam Imaging	(7) NIRCAM-7
8			NIRCam Imaging	(8) NIRCAM-8
9			NIRCam Imaging	(9) NIRCAM-9
10			NIRCam Imaging	(10) NIRCAM-10

ABSTRACT

Star-forming galaxies in the first billion years of the Universe ($z > 6$) are thought to be responsible for reionizing the intergalactic medium. To date, only a dozen galaxies that are well within the reionization era are spectroscopically confirmed, leaving the earliest star formation in galaxies virtually uncharacterized. One of the most efficient ways to identify star-forming galaxies is through narrow-band imaging surveys. Before JWST, only Ly-alpha narrow-band surveys were possible at $z > 6$, but this is the cosmic epoch where the increasingly neutral intergalactic medium makes it difficult to detect Ly-alpha. We propose a $\sim 100 \text{ arcmin}^2$ NIRCam narrow-band F470N(+F090W) survey to unambiguously identify H-alpha emitters at $z \sim 6.2$ and [OIII] emitters at $z \sim 8.4$, both within the reionization era. Unlike Ly-alpha, these lines are not affected by a neutral intergalactic medium. Our survey is designed to map the same NIRCam area covered by the Cosmic Evolution Early Release Science (CEERS) survey, which also has myriad existing, deep, multi-wavelength observations (e.g. HST, Chandra). We will identify H-alpha and [OIII] emitters with star-formation rates > 5 and > 4 M_{sun}/yr , respectively. We will provide crucial estimates of the instantaneous star formation rate, number density, luminosity function, sizes and morphologies of star-forming regions, and clustering of star-forming galaxies in the epoch of reionization. In addition, we will deliver contamination rates applicable to other studies without the wealth of information available for this particular field. This survey will have an enormous legacy value and will become a reference comparison sample for many JWST high- z studies.

OBSERVING DESCRIPTION

NIRCam observations:

We will observe 10 pointings with the NIRCam filters F470N+F090W at the same location of the NIRCam broad band observations of the Cosmic Evolution Early Release Science (CEERS) survey ($\sim 100 \text{ arcmin}^2$ in total). Capitalizing on the existing multi-wavelength data in this field (e.g., HST and Chandra) and future JWST CEERS observations we design a narrow-band survey using the F470N filter to identify H-alpha and [OIII] emitting galaxies at $z \sim 6.2$ and $z \sim 8.4$, respectively.

We will measure their number densities, equivalent width distribution, sizes, morphologies, and star formation rates. The F090W filter will be used to separate [OIII] from H-alpha emitters. We will obtain robust constraints on the star formation rate density at $z \sim 6.2$ for the first time based on H-alpha luminosity function and lower limit for star formation rate density at $z \sim 8.4$. As legacy, we will provide a rate of contaminants for other narrow band studies with similar design but with limited ancillary data.

To achieve the required depth we use 10 groups, 1 integration, and 4 dithers with the MEDIUM8 readout pattern. This results in ~ 70 minutes observations per pointing. Possible position angles for NIRCcam observations to match the CEERS strategy are $125\text{-}135^\circ$ or $305\text{-}315^\circ$. Using the same PA for all pointings results in smaller overheads. Therefore, we chose $PA=305\text{-}315^\circ$ for all observations. However, the position angles of our observations can be changed to $PA=125\text{-}135^\circ$ for increased scheduling flexibility.

Proposal 2234 - Targets - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NIRCAM-1	RA: 14 19 56.1929 (214.9841371d) Dec: +52 58 38.78 (52.97744d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(2)	NIRCAM-2	RA: 14 19 34.8022 (214.8950092d) Dec: +52 54 50.35 (52.91399d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(3)	NIRCAM-3	RA: 14 19 12.6730 (214.8028042d) Dec: +52 51 3.54 (52.85098d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(4)	NIRCAM-4	RA: 14 19 2.0648 (214.7586033d) Dec: +52 46 6.85 (52.76857d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(5)	NIRCAM-5	RA: 14 19 46.0325 (214.9418021d) Dec: +52 53 37.64 (52.89379d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(6)	NIRCAM-6	RA: 14 19 25.2331 (214.8551379d) Dec: +52 49 55.98 (52.83222d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(7)	NIRCAM-7	RA: 14 20 25.7256 (215.1071900d) Dec: +52 57 12.26 (52.95341d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				
(8)	NIRCAM-8	RA: 14 20 3.4712 (215.0144633d) Dec: +52 53 21.94 (52.88943d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>				

Fixed Targets

Proposal 2234 - Targets - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

(9)	NIRCAM-9	RA: 14 19 41.1292 (214.9213717d) Dec: +52 49 35.93 (52.82665d) Equinox: J2000
<i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i>		
(10)	NIRCAM-10	RA: 14 19 18.9531 (214.8289712d) Dec: +52 45 50.21 (52.76395d) Equinox: J2000
<i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i>		

Proposal 2234 - Observation 1 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	Proposal 2234, Observation 1 Diagnostic Status: Warning Observing Template: NIRCam Imaging									
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(1)	NIRCAM-1	RA: 14 19 56.1929 (214.9841371d) Dec: +52 58 38.78 (52.97744d) Equinox: J2000							
	<i>Comments:</i> Category=Galaxy Description=[Emission line galaxies, High-redshift galaxies]									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Aperture PA Range 130.6776469 to 130.6796469 Degrees (V3 130.749 to 130.751) Same Aperture PA 1, 2 Same Aperture PA 1, 3 Same Aperture PA 1, 4 Same Aperture PA 1, 5 Same Aperture PA 1, 6 Same Aperture PA 1, 7 Same Aperture PA 1, 8 Same Aperture PA 1, 9 Same Aperture PA 1, 10									

Proposal 2234 - Observation 2 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCcam Imaging</p>									
Diagnostics	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(2)	NIRCAM-2	RA: 14 19 34.8022 (214.8950092d)							
			Dec: +52 54 50.35 (52.91399d)							
			Equinox: J2000							
	<p><i>Comments:</i></p> <p><i>Category=Galaxy</i></p> <p><i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 2									

Proposal 2234 - Observation 3 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 3</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCcam Imaging</p>									
Diagnostics	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(3)	NIRCAM-3	RA: 14 19 12.6730 (214.8028042d)							
			Dec: +52 51 3.54 (52.85098d)							
			Equinox: J2000							
	<p><i>Comments:</i></p> <p><i>Category=Galaxy</i></p> <p><i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 3									

Proposal 2234 - Observation 4 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 4</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCAM Imaging</p>									
Diagnostics	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(4)	NIRCAM-4	RA: 14 19 2.0648 (214.7586033d) Dec: +52 46 6.85 (52.76857d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 4									

Proposal 2234 - Observation 5 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 5</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p>									
Diagnostics	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(5)	NIRCAM-5	RA: 14 19 46.0325 (214.9418021d) Dec: +52 53 37.64 (52.89379d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 5									

Proposal 2234 - Observation 6 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 6</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p>									
Diagnostics	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous		
	(6)	NIRCAM-6	RA: 14 19 25.2331 (214.8551379d) Dec: +52 49 55.98 (52.83222d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description= Emission line galaxies, High-redshift galaxies </i></p>									
Template	Module					Subarray				
	ALL					FULL				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 6									

Proposal 2234 - Observation 7 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 7</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p>									
Diagnostics	(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(7)	NIRCAM-7	RA: 14 20 25.7256 (215.1071900d) Dec: +52 57 12.26 (52.95341d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 7									

Proposal 2234 - Observation 8 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 8</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCAM Imaging</p>									
Diagnostics	(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(8)	NIRCAM-8	RA: 14 20 3.4712 (215.0144633d) Dec: +52 53 21.94 (52.88943d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 8									

Proposal 2234 - Observation 9 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 9 Diagnostic Status: Warning Observing Template: NIRCam Imaging</p>									
Diagnostics	(Visit 9:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(9)	NIRCAM-9	RA: 14 19 41.1292 (214.9213717d) Dec: +52 49 35.93 (52.82665d) Equinox: J2000							
	<p><i>Comments:</i> Category=Galaxy Description=[Emission line galaxies, High-redshift galaxies]</p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 9									

Proposal 2234 - Observation 10 - The JWST-legacy narrow-band survey of H-alpha and [OIII] emitters in the epoch of reionization

Thu Dec 08 23:00:59 GMT 2022

Observation	<p>Proposal 2234, Observation 10</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCAM Imaging</p>									
Diagnostics	(Visit 10:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections			Miscellaneous		
	(10)	NIRCAM-10	RA: 14 19 18.9531 (214.8289712d) Dec: +52 45 50.21 (52.76395d) Equinox: J2000							
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Emission line galaxies, High-redshift galaxies]</i></p>									
Template	Module				Subarray					
	ALL				FULL					
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	INTRAMODULEBOX		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F090W	F470N+F444W	MEDIUM8	10	1	4	4	4208.814	
Special Requirements	Same Aperture PA 1, 10									